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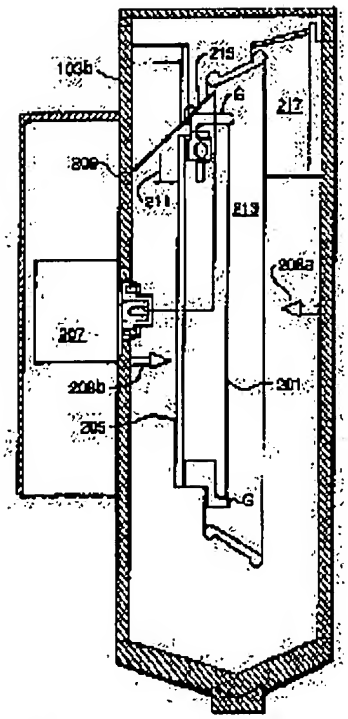
(54) **SPIN RINSE DRYER**



(57)Abstract:
PROBLEM TO BE SOLVED: To provide an apparatus for quickly rinsing and drying a semiconductor substrate with high reliability.
SOLUTION: This spin dryer has a shielding system, positioned to receive fluid displaced from a substrate vertically positioned within the spin dryer. The shielding system has one or more shields 213, 215 and 217, positioned to at least partially reflect fluid therefrom as the fluid impacts the shield. The shield or shields are angled to promote the flow of fluid therealong and are preferably hydrophilic, to prevent droplets from forming. By adding a pressure gradient across the interior of the spin dryer to create an air flow which encourages the fluid to travel along the shielding system in the desired direction.

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CLAIMS

[Claim(s)]
[Claim 1] A vertical mold SRD equipped with 1st at least one shielding which rebounds the fluid which received from the substrate which has been arranged so that the fluid which moved from the substrate base material made to hold and rotate a longitudinal substrate, the fluid source which supplies a fluid to the front face of the substrate arranged on said substrate base material, and the substrate which is rotating on said substrate base material may be received, and has been arranged on said substrate base material.
[Claim 2] Said 1st shielding is the vertical mold SRD according to claim 1 with which it has the smooth substrate opposed face which inclined from the height of the higher one nearest to the 1st field of said substrate to the height of the lower one nearest to the 2nd field of said substrate, and a fluid flows in the margo-inferior section of said 1st shielding along with said substrate opposed face.
[Claim 3] The vertical mold SRD according to claim 2 further equipped with the high-pressure field nearest to said 1st field of said substrate, and the low voltage field nearest to said 2nd field of said substrate.
[Claim 4] It is the horizontally movable vertical mold SRD according to claim 1 so that said 1st shielding may make possible overhead substrate loading to said substrate base material, and overhead substrate unloading from said substrate base material.
[Claim 5] The vertical mold SRD according to claim 2 which has the non-substrate opposed face in which said 1st shielding has an upheaval edge nearest to said 1st field of said substrate.
[Claim 6] The vertical mold SRD equipped with 1st at least one shielding which is arranged so that the fluid which moved from the substrate base material made to hold and rotate a longitudinal substrate, the fluid source which supplies a fluid to the front face of the substrate arranged on said substrate base material, and the substrate which is rotating on said substrate base material may be received, and contains the substrate opposed face of a hydrophilic property.
[Claim 7] The vertical mold SRD according to claim 6 with which the substrate opposed face of said 1st shielding inclines smoothly from the height of the higher one nearest to the 1st field of said substrate to the height of the lower one nearest to the 2nd field of said substrate, and a fluid flows in the margo-inferior section of said 1st shielding along with said substrate opposed face.
[Claim 8] The vertical mold SRD according to claim 7 further equipped with the high-pressure field nearest to said 1st field of said substrate, and the low voltage field nearest to said 2nd field of said substrate.
[Claim 9] The vertical mold SRD according to claim 8 which rebounds the fluid which said 1st shielding received from the substrate arranged on said substrate base material.
[Claim 10] It is the horizontally movable vertical mold SRD according to claim 6 so that said 1st shielding may make possible overhead substrate loading to said substrate base material, and overhead substrate unloading from said substrate base material.
[Claim 11] The vertical mold SRD according to claim 7 which has the non-substrate opposed face in which said 1st shielding has an upheaval edge nearest to said 1st field of said substrate.
[Claim 12] Two or more perpendicular and vertical molds SRD equipped with a shielding

system including shielding arranged alternately horizontally to which it is arranged so that the fluid emitted from the substrate base material made to hold and rotate a longitudinal substrate, the fluid source which supplies a fluid to the front face of the substrate arranged on said substrate base material, and the substrate which is rotating on said substrate base material may receive, and a fluid moves from the medial axis of said substrate.

[Claim 13] It is the main shielding which has the substrate opposed face toward which said shielding system inclined from the height of the higher one nearest to the 1st field of said substrate to the height of the lower one nearest to the 2nd field of said substrate. The main shielding with which a fluid flows in the margo-inferior section of the main shielding along with said substrate opposed face, It is arranged at height lower than said main shielding, and extends to the part which exceeded said margo-inferior section of said main shielding from the part of the lower part of said main shielding. The vertical mold [equipped with lower part shielding which inclines from the height of the higher one nearest to said margo-inferior section of said main shielding to the height of the most distant lower one from said main shielding] SRD according to claim 12.

[Claim 14] The vertical mold SRD according to claim 13 with which it has further a high-pressure field nearest to said 1st field of said substrate, and a low voltage field nearest to said 2nd field of said substrate, and only distance with said narrow main shielding and said lower part shielding assists migration of the fluid with which it is perpendicularly estranged and the gas stream from said high-pressure field to said low voltage field met said substrate opposed face of said main shielding.

[Claim 15] The vertical mold SRD according to claim 14 further equipped with upper part shielding which has been arranged at height higher than said main shielding, was prolonged to the part which crossed the rising wood of said main shielding from the upper part of said main shielding, and inclined from the height of the lower one nearest to said rising wood of said main shielding to the height of the most distant higher one from said main shielding.

[Claim 16] The vertical mold SRD according to claim 15 with which only distance with said narrow main shielding and said upper part shielding assists migration of the fluid with which it is perpendicularly estranged and the gas stream from said high-pressure field to said low voltage field met the substrate opposed face of said upper part shielding.

[Claim 17] The non-substrate opposed face of said main shielding is the vertical mold SRD according to claim 13 which has the upheaval edge nearest to the 1st field of said substrate.

[Claim 18] The non-substrate opposed face of said lower part shielding is the vertical mold SRD according to claim 13 which has the upheaval edge nearest to said main shielding.

[Claim 19] The non-substrate opposed face of said lower part shielding is the vertical mold SRD according to claim 17 which has the upheaval edge along the edge nearest to said main shielding.

[Claim 20] It is the horizontally movable vertical mold SRD according to claim 13 so that said main shielding may make possible overhead substrate loading to said substrate base material, and overhead substrate unloading from said substrate base material.

[Claim 21] It is the main shielding which has the substrate opposed face toward which said shielding system inclined from the height of the higher one nearest to the 1st field of

said substrate to the height of the lower one nearest to the 2nd field of said substrate. The main shielding with which a fluid flows in the margo-inferior section of the main shielding along with said substrate opposed face, It is arranged at height higher than said main shielding, and extends to the part which crossed the rising wood of said main shielding from the upper part of said main shielding. The vertical mold [equipped with upper part shielding which inclined from the height of the lower one nearest to said rising wood of said main shielding to the height of the most distant higher one from said main shielding] SRD according to claim 12.

[Claim 22] The vertical mold SRD according to claim 15 with which only distance with said narrow main shielding and said upper part shielding assists migration of the fluid with which it is perpendicularly estranged and the gas stream from said high-pressure field to said low voltage field met the substrate opposed face of said upper part shielding.

[Claim 23] The approach which are rotation, a rinse, and the approach of drying about a substrate, and is equipped with the step which rotates a longitudinal substrate, the step which injects a fluid on this revolving substrate, and the step which rebounds the fluid from said substrate partially at least when said fluid moves to the upper field of said substrate to said substrate.

[Claim 24] The approach according to claim 23 of equipping further the location which is not the upper part of said substrate with the step which opens a fluid partially at least along the field of the hydrophilic property located above said substrate.

[Claim 25] The approach according to claim 23 further equipped with the step which moves a fluid to the non-substrate opposed face of the 2nd shielding from the substrate opposed face of the 1st shielding located above said substrate.

[Claim 26] The approach according to claim 25 further equipped with the step which sends air to said substrate through said 1st and 2nd shielding.

[Claim 27] Said approach which are rotation, a rinse, and the approach of drying about a substrate, and is equipped with the step turning around a longitudinal substrate, the step which injects a fluid on this revolving substrate, and the step which opens a fluid partially at least in the location which there is along the hydrophilic side of said substrate upper part, and is not in said substrate upper part.

[Claim 28] The approach according to claim 27 further equipped with the step which moves a fluid to the non-substrate opposed face of the 2nd shielding from the substrate opposed face of the 1st shielding arranged above said substrate.

[Claim 29] The approach according to claim 28 further equipped with the step which goes through said 1st and 2nd shielding, and sends air to said substrate.

[Claim 30] The approach which are rotation, a rinse, and the approach of drying about a substrate, and is equipped with the step which rotates a longitudinal substrate, the step which injects a fluid on this revolving substrate, and the step to which the fluid from the field of said substrate upper part is moved through two or more shielding.

[Claim 31] The approach according to claim 30 further equipped with the step which sends air to said substrate through said two or more shielding.

[Claim 32] The approach according to claim 30 further equipped with the step which opens a fluid along one or more hydrophilic fields of two or more of said shielding.

[Claim 33] The approach according to claim 30 further equipped with the step which rebounds the fluid from said substrate partially at least when said fluid moves to the upper field of said substrate to said substrate.

[Claim 34] The approach according to claim 30 further equipped with the step which is horizontally moved to the location which is not in the upper part of the location of said substrate upper part at least one to said substrate of said two or more shielding, and carries out the unload of said longitudinal substrate from a substrate base material after that.
[Claim 35] The rotation substrate base material which is a substrate spinner, is made to hold and rotate a substrate, and has one or more fixed grippers of a lot, and one or more grippers of a lot which can be opened and closed, They are one or more actuator pins of the lot of the number corresponding to the number of the grippers which can be opened and closed. The actuator pin which is connected within the substrate spinner concerned so that it may not rotate with said rotation substrate base material, and can move between the 1st location and the 2nd location, The device which carries out alignment of the gripper of said lot which can be opened and closed ahead [of the actuator pin of said lot] when said actuator pin is in said 1st location, The substrate spinner which can open said gripper which can be opened and closed by said actuator pin when alignment of a preparation and said gripper which can be opened and closed is carried out ahead [of said actuator pin] and said actuator pin takes said 2nd location.
[Claim 36] The substrate spinner according to claim 35 by which alignment is carried out so that the core of said substrate may shift in the direction of said fixed gripper from the core of said rotation substrate base material, and the fixed gripper of said lot and the gripper of said lot which can be opened and closed may support a substrate.
[Claim 37] A substrate spinner equipped with a rotation substrate base material, the flag prolonged from said rotation substrate base material, and the proximity sensor arranged at remoteness so that it may be the proximity sensor which can detect said flag and may not rotate with said rotation substrate base material.
[Claim 38] Housing which has housing and a plenum open for free passage along the 2nd side face by having one or more air holes along the 1st side face, Are the substrate base material arranged in a chamber, and the 1st main front face counters with said one or more air holes. A spinner dryer equipped with the substrate base material which a substrate is supported so that the 2nd main front face may counter with said plenum, differential pressure arises, and air is drawn through said air hole, crosses said substrate arranged on said substrate base material, and can flow into said plenum.
[Claim 39] The spinner dryer according to claim 38 further equipped with a narrow dryer style so that the air which is the dryer style which has one or more openings arranged so that it may be located near the substrate arranged on said substrate base material, is prolonged along with the diameter of said substrate, and flows from said air hole to said plenum can contact said the greater part of substrate front face.
[Claim 40] A spin dryer equipped with a substrate base material and the dryer style which supplies a gas reservoir style to the front face of the substrate supported on said substrate base material.
[Claim 41] The end effector which is an end effector which supports a thin disk, has been arranged in the opposite side of roundish [wore on the lengthwise direction / 1st], and said 1st front face, and was connected with said 1st front face so that the trough which can support a substrate might be formed and which equips a lengthwise direction with roundish [wore / 2nd].
[Claim 42] Equipment according to claim 41 further equipped with the hole which is

arranged in the part where said 1st front face and said 2nd front face touch, and can discharge a fluid.
[Claim 43] Equipment according to claim 41 said whose 1st front face and said 2nd front face are a hydrophilic property.
[Claim 44] Equipment according to claim 41 said whose 1st front face is a hydrophilic property.
[Claim 45] Equipment according to claim 41 with said 1st front face roundish [with equipment] in the longitudinal direction, and said 2nd front face [wear on the longitudinal direction].
[Claim 46] Equipment according to claim 42 with said 1st front face roundish [with equipment] in the longitudinal direction, and said 2nd front face [wear on the longitudinal direction].
[Claim 47] Equipment according to claim 43 with said 1st front face roundish [with equipment] in the longitudinal direction, and said 2nd front face [wear on the longitudinal direction].
[Claim 48] Equipment according to claim 44 with said 1st front face roundish [with equipment] in the longitudinal direction, and said 2nd front face [wear on the longitudinal direction].
[Claim 49] The end effector which is an end effector which supports a thin disk, was located in the opposite side of roundish [wore on the longitudinal direction / 1st], and said 1st front face, and was connected with said 1st front face so that the trough which can support a substrate might be formed and which equips a longitudinal direction with roundish [wore / 2nd].
[Claim 50] The end effector according to claim 49 further equipped with the hole which is arranged in the part where said 1st front face and said 2nd front face touch, and can discharge a fluid.
[Claim 51] The end effector according to claim 49 said whose 1st front face and said 2nd front face are a hydrophilic property.
[Claim 52] The end effector according to claim 49 said whose 1st front face is a hydrophilic property.
[Claim 53] The end effector which is an end effector which supports a thin disk and is equipped with the 1st front face of a hydrophilic property, and the 2nd front face connected with said 1st front face so that the trough which is arranged in the opposite side of said 1st front face, and can support a substrate might be formed.
[Claim 54] The end effector according to claim 53 further equipped with the hole which is arranged in the part where said 1st front face and said 2nd front face touch, and can discharge a fluid.
[Claim 55] Equipment according to claim 53 said whose 2nd front face is a hydrophilic property.
[Claim 56] Equipment according to claim 54 said whose 2nd front face is a hydrophilic property.
[Claim 57] An end effector equipped with the hole which is the end effector which supports a thin disk, is arranged in the part where the 1st front face, the 2nd front face connected with said 1st front face so that the trough which is arranged in the opposite side of said 1st front face, and can support a substrate might be formed, and said 1st front face and said 2nd front face touch, and can discharge a fluid.

[Claim 58] The approach which is the approach of drying a thin disk and is equipped with the step which supports a thin disk by two or more end effectors, the step which rotates said thin disk and said two or more end effectors at sufficient rate in order to move a fluid from said thin disk, and the step which moves a sink and a fluid for a fluid to the lengthwise direction of two or more of said end effectors from the front face along roundish [wore].
[Claim 59] The approach according to claim 58 further equipped with the step which moves a sink and a fluid for a fluid to the longitudinal direction of two or more of said end effectors from the front face along roundish [wore].
[Claim 60] The approach according to claim 59 further equipped with the step which pours a fluid through the hole arranged in the trough formed by counterposing the front faces of an end effector.
[Claim 61] The approach according to claim 58 further equipped with the step which pours a fluid through the hole arranged in the trough formed by counterposing the front faces of an end effector.
[Claim 62] The approach according to claim 58 further equipped with the step which rebounds a liquid from the front face of said end effector.
[Claim 63] The approach according to claim 59 further equipped with the step which rebounds a liquid from the front face of said end effector.
[Claim 64] The approach according to claim 60 further equipped with the step which rebounds a liquid from the front face of said end effector.
[Claim 65] The approach which is the approach of drying a thin disk and is equipped with the step which supports a thin disk by two or more end effectors, the step which rotates said thin disk and said two or more end effectors at sufficient rate in order to move a fluid from said thin disk, and the step which rebounds a liquid from the front face of said end effector.
[Claim 66] An approach equipped with the step which pours a fluid through the hole arranged in the step which is the approach of drying a thin disk and supports a thin disk by two or more end effectors, the step which rotates said thin disk and said two or more end effectors at sufficient rate in order to move a fluid from said thin disk, and the trough formed by counterposing the front faces of an end effector.
[Claim 67] The approach which is the approach of drying a thin disk and is equipped with the step which supports a thin disk by two or more end effectors, the step which rotates said thin disk and said two or more end effectors at sufficient rate in order to move a fluid from said thin disk, and the step which moves a sink and a fluid for a fluid to the longitudinal direction of two or more of said end effectors from the front face along roundish [wore].
[Claim 68] The approach according to claim 67 further equipped with the step which pours a fluid through the hole arranged in the trough formed by counterposing the front faces of an end effector.
[Claim 69] The approach according to claim 67 further equipped with the step which rebounds a liquid from the front face of said end effector.
[Claim 70] An end effector equipped with roundish [which is the end effector which supports a thin disk, has been arranged in the opposite side of roundish / wore / 1st / and said 1st front face, and was connected with said 1st front face so that the trough which can support a substrate might be formed / wore / 2nd].

[Claim 71] The vertical mold SRD equipped with the chamber which has the lid part which is a vertical mold SRD, are the substrate base material made to support and rotate a longitudinal substrate, the fluid source which can supply a fluid to the front face of the substrate arranged on said substrate base material, and the chamber which surrounds said substrate base material, and is equipped with the inclination where it is made for a fluid to flow from the upper field of said substrate base material.
[Claim 72] The approach which is the approach of carrying out the spin rinse of the longitudinal substrate, and is equipped with the step which rotates a substrate at a rate quick enough in order to move a fluid to the rising wood of said substrate up from the step which supports a substrate to longitude, the step which injects a fluid on said substrate, and the core of said substrate.
[Claim 73] The method according to claim 72 of rotating said substrate at the rate of 400 or more rpm.
[Claim 74] The method according to claim 72 of rotating said substrate at the rate of 400rpm.
[Claim 75] Two or more substrate grippers to which it is a substrate spinner, is two or more substrate grippers connected with the rotation substrate base material and said substrate base material, and at least one of them can move now between an open position and closed positions alternatively, The operation system which is connected within the spinner concerned so that it may not rotate with said substrate base material, and can move alternatively between the 1st location and the 2nd location, The substrate spinner which said operation system contacts said at least one substrate gripper, and makes move said at least one substrate gripper to said open position from said closed position when a preparation and said operation system move to said 2nd location from said 1st location.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach of washing and drying thin disks, such as a glass substrate, a flat-panel display, a pattern formation settled, or a semi-conductor substrate by which pattern formation is not carried out. Especially this invention relates a semi-conductor substrate to a rinse and the advanced spin-rinse-dryer to dry.
[0002]
[Description of the Prior Art] The importance of super-washing processing is increasing

as the geometry of a semiconductor device continues reduction. Aquosity washing in a fluid tank (or tub) and the rinse process (for example, what is immersed in a rinse fluid in a substrate and the thing which injects a rinse fluid to a substrate) following it attain a desirable cleanliness level. However, if a dryer is not used after a rinse is completed, a rinse fluid will evaporate from a substrate front face, and a streaking and spotting will arise, and/or tub residue will remain on the front face of a substrate. Such a streaking, spotting, and residue cause a device defect later. Therefore, many cautions have been turned to improving the approach of drying a substrate after the last rinse step.
[0003] In addition to performing desiccation without a streak, such an approach must be able to dry a substrate promptly so that a throughput may be raised, and it must not give a bottleneck to the whole substrate processing system.
[0004]
[Problem(s) to be Solved by the Invention] Therefore, a rinse, the approach of drying, and equipment are promptly asked for substrates, such as a semi-conductor substrate, with high dependability.
[0005]
[Means for Solving the Problem] This invention offers an advanced spin rinse dryer (spin-rinse-drier:SRD). This spin rinse dryer is equipped with the substrate base material made to hold and rotate a longitudinal substrate and the fluid source of the substrate arranged on a substrate base material which can supply a fluid to both sides preferably. Furthermore in the 1st mode, this spin rinse dryer is equipped with 1st at least one shielding designed so that a rinse fluid might be removed from the circumference of a substrate. Especially this shielding is designed so that a rinse fluid may be removed from the field from which a drop can be dropped on the substrate located downward. Therefore, it sets like the 1st voice, and shielding is arranged so that the fluid which moved from this substrate that rotates on a substrate base material may be received, and it rebounds the fluid which received from the substrate. In the 2nd mode, shielding is arranged so that the fluid which moved from the substrate which rotates on a substrate base material may be received, and it contains the substrate opposed face of a hydrophilic property. It is good also considering the whole substrate opposed face of shielding as a hydrophilic property, and shielding of a non-hydrophilic property may be equipped with a hydrophilic wafer opposed face (in for example, field above a substrate). SRD of this invention is equipped with perpendicular and the shielding system which has two or more shielding arranged alternately horizontally in the 3rd mode. These shielding is arranged so that the fluid which moved from the substrate which rotates on a substrate base material may be received, and it can carry and remove a fluid from the field of the substrate upper part. Although used on these specifications, shielding or the shielding system which is arranged alternately perpendicularly or was indicated to have various height and inclinations points out the up field of shielding. The flank and lower field of shielding can have other configurations.
[0006] Other modes of this invention may include/or the still more advantageous description, including various combination of the above-mentioned mode. For example, SRD of this invention may have the pressure gradient impressed in order to carry out induction of the layer air current which crosses a substrate front face and to promote desiccation. You may have narrow spacing perpendicularly so that an air current may promote migration of a fluid in the desirable direction which has arranged two or more

shielding so that an air current may be further sent toward a substrate, and met shielding. The lid of SRD of this invention may be a hydrophilic property (in order to promote not formation of a drop but the intense flow of a fluid), and it may incline in order to draw the flow of a fluid in/or the desirable direction. Furthermore, another mode contains the possible sensor and possible flag of detecting the flywheel of a desired location. The step which supplies a rinse fluid to a substrate, rotating a substrate with the speed of per minute 400 rotation at least is included. The gripper which has the remote pin which can open alternatively the gripper which has the hole or slot which is the gripper which was energized toward closed arrangement, and in which two or more closing motion is free, and has been arranged in the part where a gripper and a substrate contact is included. And/or, it is equipped with the desirable gripper with a radius of circle that it is roundish in two or more directions.

[0007] Other descriptions and advantages of this invention will become clear further enough from detailed explanation of the following suitable operation gestalt, a claim, and an attached drawing.

[0008]

[Embodiment of the Invention] For convenience, it lets the whole drawing pass and the figure on the left of a sign identifies the drawing with which a sign comes out first.

[0009] Drawing 1 and drawing 2 are the front views and tooth-back perspective views showing SRD101 of a rinse and this invention rotated and dried for longitudinal thin disks, such as a semi-conductor substrate, respectively. SRD101 contains housing 103 and front 103a of housing 103 has two or more opening or air hole 105 a-f by which pure air enables it to go into housing 103. The plenum 107 is arranged along with tooth-back 103b of housing 103. A plenum 107 is exhausted through exhaust air Rhine 109, and is connected with the pump (not shown). Since bolting of the top-face 103c of housing 103 is carried out to the side attachment wall of housing 103, when the internal components of SRD101 need after-sale service, it can remove top-face 103c from housing. Since top-face 103c of the SRD housing 103 inclines from the 103d of the 1st side attachment wall to 2nd side-attachment-wall 103e, the fluid which gather on top-face 103c flows to the low top-face 103c side, and flows and falls along with 2nd side-attachment-wall 103e. The heat lamp assembly 111 includes the heat lamp 115 held in the housing 113 attached in front 103a of the SRD housing 103, and housing 113, and the quartz shielding 117. The quartz shielding 117 constitutes a part of front 103a of the SRD housing 103, and it is built with the quartz so that light can be penetrated from a heat lamp 115 to a substrate 201 (see drawing 2). The heat lamp assembly 111 is prolonged covering the die length of the diameter of a substrate 201, and if a substrate 201 rotates, the substrate 201 whole will be heated.

[0010] Top-face 103c of the SRD housing 103 has insertion and the opening 118 of magnitude which can be pulled out for a substrate. In order to open and close opening 111, the door 120 which can be slid is attached on truck 123a of a pair, and 123b so that it may slide forward and backward. 103f of bottom walls of SRD housing inclines toward the lower order point 117. A drain pipe 119 is connected with 103f of bottom walls at the lower order point 117, and removes a rinse fluid from a bottom wall. The feet 121a and 121b of the pair connected with 103f of bottom walls of SRD housing are supporting SRD101. The internal components of SRD101 of this invention are explained with reference to drawing 3 .

[0011] Drawing 3 is the sectional side elevation showing the related part of SRD101 concerning this invention of drawing 1 . The substrate 201 in SRD101 of this invention is illustrated as supported by the gripper G of the pair prolonged from the pivotable flywheel 205. Another gripper (shown as 403 a-c and 405 a-b) is shown in drawing 5 . A flywheel 205 is connected with a motor 207 through opening of tooth-back 103b of SRD housing. The rinse hydraulic nozzles 208a and 208b of a pair are connected with the source (not shown) of a rinse fluid, and they are arranged so that a rinse fluid may be supplied to the core of the front face of a substrate 201, and a tooth back, respectively. The proximity sensor 209 (for example, capacitive or an inductive proximity sensor) has penetrated the tooth back of SRD housing so that existence of the metal flag 211 attached in the flywheel 205 may be detected. The shielding system including the main shielding 213, the lower part shielding 215, and the upper part shielding 217 encloses the substrate 201. This is separately shown in drawing 4 , and it is explained further, referring to drawing 4 .

[0012] Drawing 4 is the sectional side elevation of the shielding system of SRD concerning this invention of drawing 1 . The desirable main shielding 213 can be explained to be the intercept of the cone which encloses the whole periphery of the substrate 201 arranged on a flywheel 205 (drawing 3). Therefore, the main shielding 213 inclines from a big diameter to the small diameter nearest to a flywheel 205 (drawing 3). The include angle of the substrate opposed face of the main shielding 213 is desirable, and, as for these diameters, it is desirable the range and to be chosen [5-45 degrees (from a normal)] so that it may become 18 degrees most preferably. The substrate opposed face of the main shielding 213 is smooth, and it is desirable that it is a hydrophilic property so that the fluid from the substrate 201 which collides with the substrate opposed face of the main shielding 213 may be rebounded from a substrate opposed face, and/or so that it may prevent flowing along with a substrate opposed face, and a drop's occurring, and falling on a substrate 201. Since the hydrophilic ingredient (for example, quartz) is expensive, it is also possible to use non-hydrophilic-property shielding (for example, plastics shielding), and hydrophilic ingredients, such as a quartz, are attached inside the part of a request of non-hydrophilic-property shielding so that the wafer opposed face or liner of a hydrophilic property may be formed. For example, as shown in drawing 4 , quartz liner 213a may be used for the field (for example, upper half of the main shielding 213) of the substrate upper part. The substrate opposed face and external surface of the main shielding are parallel, and external surface and a substrate opposed face share common inclination between a suitable operation gestalt. It has the upheaval fields 301a and 301b along both edges, a rinse fluid escapes across each edge of the upper external surface of the main shielding 213, and the external surface of the main shielding 213 prevents flowing on the substrate 201 arranged under it.

[0013] Since the main shielding 213 encloses the substrate 201, the main shielding 213 is connected with the 103d (drawing 1) of the 1st side attachment wall of SRD housing, and 2nd side-attachment-wall 103e (drawing 3) by the pneumatic system links 401a and 401b (drawing 5) of a pair. Therefore, the main shielding 213 moves so that insertion of a substrate 201 and a cash drawer may be made, and it separates from Gripper G (drawing 3). The main shielding 213 could move ahead uniformly from Gripper G, or the up field of the main shielding 213 may fully lean ahead so that insertion of a substrate 201 and a cash drawer may become possible.

[0014] Drawing 4 is explained again. The desirable lower part shielding 215 can also be explained to be the intercept of the cone form which encloses the upper half of the periphery of a substrate 201. The lower part shielding 215 inclines from a big radius to the small radius nearest to a flywheel 205 (drawing 3). the range whose include angle of the substrate opposed face of the lower part shielding 215 of these radii is 5-45 degrees -- since it is chosen so that it may be 36 degrees most preferably, a rinse fluid flows along with a substrate opposed face, and separates from a substrate 201. With a suitable operation gestalt, the substrate opposed face and external surface of the lower part shielding 215 are parallel. The lower part shielding 215 is connected with tooth-back 103b of SRD housing through the bracket 303.

[0015] The upper part shielding 217 can be explained to be a cone intercept, and encloses the upper parts 1/4 of the periphery of a substrate 201. [as well as the main shielding 213 and the lower part shielding 215] The upper part shielding 217 inclines from a big radius to the small radius nearest to a flywheel 205 (drawing 3). the range whose include angle of the substrate opposed face of the upper part shielding 217 of these radii is 5-45 degrees -- since it is chosen so that it may become 10 degrees most preferably, a rinse fluid flows to the direction of the main shielding 213 along with a substrate opposed face (it mentions later further). The upper part shielding 217 is connected with front 103a (drawing 1) of SRD housing through the bracket.

[0016] when a flywheel rotates, the main shielding 213, the lower part shielding 215, and the upper part shielding 217 are perpendicular so that the fluid which moved from the flywheel 205 (drawing 3) may be received -- and it is arranged alternately horizontally and a fluid is moved from the upper field of a substrate 201. With the suitable operation gestalt, the edge with the lower height of the upper part shielding 217 (or edge where a diameter is small) lapped with the edge with the higher height of the main shielding 213 (or edge where a diameter is large), and the edge with the lower height of the main shielding 213 has lapped with the edge with the higher height of the lower part shielding 215 as illustrated. The edge of adjoining shielding is that which is ****(ed) by approaching perpendicularly (for example, 0.3 inches), and in the upper field of a substrate 201, a fluid flows from the substrate opposed face of high shielding of height to the external surface of lower shielding of the height located most in near, stopping a droplet to the minimum. Spacing of the perpendicularly shielding 213, 215, and 217 approached makes easy migration of the fluid which met the shielding system (about the whole actuation of SRD101 of this invention, it mentions later further). Although the desirable upper part and lower part shielding have extended only around the upper part of a substrate, you may extend so that either or both sides may surround the part of the arbitration of a substrate, or the whole periphery. Such extension promotes the flow of the air in the perimeter of the whole periphery of a substrate, and prevents a turbulent flow. Similarly, the main shielding 213 can offer a desirable fluid style and fluid reflection, when having extended only along the upper part of a substrate 201.

[0017] Drawing 5 is the transverse-plane sectional view of SRD concerning this invention of drawing 1 . Three fixed gripper 403 a-c and two movable gripper 405 a-b are contained in two or more grippers ("G" of drawing 3) which support a substrate 201. Fixed gripper 403 a-c and movable gripper 405 a-b are connected with the flywheel 205. Each of each gripper 403 a-c and 405 a-b contains the end effector 407 and the finger part 409. the finger part 409 is indicated by drawing 9 (a) and (b) -- as -- a flywheel 205 -- the

fixed coupling -- or it is constituted so that movable connection may be carried out. The end effector 407 of the both sides of fixed gripper 403 a-c and the movable gripper 405 is constituted so that it may avoid catching a fluid and making it adhere to a substrate 201, while supporting a substrate 201 by the minimum contact. The configuration of an end effector 407 is best understood by drawing 6 and drawing 7 .

[0018] Drawing 6 and drawing 7 are the side elevations and front views of an end effector 407 of SRD101 which are applied to this invention, respectively. Drawing 8 is the perspective view of an end effector 407. An end effector 407 consists of two proximal regions 411a and 411b, it has joined these so that a trough may be made, and it supports a substrate 201 by the minimum contact. A slot or a hole 413 is arranged to the field which proximal regions 411a and 411b join, and a fluid separates from a substrate 201 and may enable it to flow through a hole 413.

[0019] When a substrate is lowered, fixed gripper 403 a-c is ****(ed) along the bottom of a flywheel 205 so that a substrate 201 may be supported in horizontal and the location fixed on vertical both sides. Proximal regions 411a and 411b are roundish to the both sides of a lengthwise direction (between the finger part 409 and substrates 201), and a longitudinal direction (direction which frequents the space of drawing 6), as shown in drawing 6 and drawing 7 , respectively. The front face of proximal regions 411a and 411b is a hydrophilic property smoothly and preferably. Therefore, if the flywheel 205 rotated, a fluid flows along the smooth front face with a radius of circle of proximal regions 411a and 411b, and keep not contacted to a substrate 201. Ideally, two or more gripper 403 a-c and 405 a-b are arranged so that the core of the substrate 201 supported by it may come in the direction of fixed gripper 403 a-c below the core of a flywheel 205 (for example, the core of a flywheel below 0.1-3mm, most preferably under 1mm). By doing in this way, rotation of a substrate 201 pushes a substrate 201 on the direction of fixed gripper 403 a-c. Since fixed gripper 403 a-c does not open, even if a flywheel 205 rotates, it is hard to separate from a substrate 201.

[0020] Drawing 9 (a) and (b) are the side-face perspective views of the movable grippers 405a and 405b in an open position and a closed position, respectively. Each of the movable grippers 405a and 405b contains the base parts 601a and 601b, respectively. In order to open the movable grippers 405a and 405b, since the base parts 601a and 601b of the movable grippers 405a and 405b are contacted, respectively and the base parts 601a and 601b are extruded ahead (going to front wall 103a of SRD housing), the pneumatic system pins 603a and 603b move the finger parts 409a and 409b back, as shown in drawing 9 (a). The air press actuator for pin 603a and 603b (not shown) is held in the plenum 107, and Pins 603a and 603b are slid through opening in tooth-back 103b of SRD housing (not shown), and contact the base parts 601a and 601b of the movable grippers 405a and 405b. The springs 605a and 605b of a pair energize the movable grippers 405a and 405b to a closed position (drawing 9 (b)). In this closed position, the pins 603a and 603b which contact the base parts 601a and 601b of the movable grippers 405a and 405b, respectively do not exist.

[0021] Drawing 10 (a) and (b) are the sectional side elevations and transverse-plane sectional views showing the dryer style of the option used into SRD which starts this invention of drawing 1 , respectively. As shown in drawing 10 (a) and (b), the dryer style of an option contains the Teflon (trademark) tubing 701 preferably prolonged along with the diameter of the perpendicular direction of a substrate 201. The gas stream which the

1st edge of the Teflon tubing 701 is connected with the source 702 of semi-conductor grade clean dry inert gas (for example, nitrogen, CO2, AR, HE, etc.), and the 2nd edge of the Teflon tubing 701 has cap 703, or a seal is carried out by the option, and passes along tubing is prevented. The Teflon tubing 701 is made to approach the front face of a substrate 201, and is attached. Two or more holes 705 exist in the field of the Teflon tubing 701 which counters a substrate 201. Constituting without making magnitude project is desirable so that it may not prevent that most front faces of a substrate 201 contact the airstream which the Teflon tubing 701 or the same dryer style is drawn [airstream] through air hole 105 a-f, and has the front-face top of a substrate 201 passed through a plenum 107, and so that migration of the main shielding 213 may not be blocked (for example, the Teflon tubing 701 is attached in a front wall). As for the number between two or more holes 705, spacing and the flow rate of inert gas, and spacing of the Teflon tubing 701 and a substrate 201, a low fluidity laminar flow with smooth inert gas is chosen so that it may assist a sink and/or making it evaporate for the front face of a substrate 201 to a fluid. Since removing a fluid from the edge of a substrate 210 has more difficult possibility, spacing between holes 705 decreases in the field of the Teflon tubing 701 corresponding to the edge of a substrate 201. Other forms can be used although the dryer style of the shape of thin tubing is desirable (the shower head, a square, rectangle, etc.). Similarly, a dryer style can be made into the magnitude of arbitration (for example, area is equal to the substrate which should be dried).

[0022] It slides along Trucks 123a and 123b during actuation to the open position where opening 118 exposes a substrate 201 as a slide door 120 is shown in drawing 1 and drawing 2 , a rinse and in order to dry. A flywheel 205 has a proximity sensor 209 in the position which detects the metal flag 211 so that alignment of the base parts 601a and 601b of the movable grippers 405a and 405b may be carried out ahead [of Pins 603a and 603b]. Pins 603a and 603b are sent ahead, the base parts 601a and 601b of the movable grippers 405a and 405b are contacted, and the movable grippers 405a and 405b are opened, and it moves ahead in Links 401a and 401b, and is made for delivery and the main shielding not to surround gripper 403 a-c and 405 a-b for the main shielding 213 any longer ahead, as shown in drawing 9 (a). A substrate handler (not shown) drops a substrate 201 through opening 111, and lays a substrate 201 on fixed gripper 403 a-c. Fixed gripper 403 a-c supports a substrate 201 to the fixed position where the core of a substrate 201 is located under the core of a flywheel 205. If an air press actuator (not shown) retreats Pins 603a and 603b gradually so that the movable grippers 405a and 405b may close gradually, and a door 121 slides to a closed position, it will be set in the condition of having contacted proximal regions 411a and 411b (drawing 5 and drawing 6) to the substrate 201.

[0023] Then, a flywheel 205 begins to rotate. Since the core of a substrate 201 has shifted in the direction of fixed gripper 403 a-c from the core of a flywheel 205, rotation pushes in a substrate 201 in the direction of fixed gripper 403 a-c firmly. Therefore, the movable grippers 405a and 405b receive the minimum force, and a substrate 201 cannot separate from them easily from gripper 403 a-c and 405 a-b.

[0024] Rotating a flywheel 205 in the beginning at a low speed (for example, 100 - 500 revolution per minute (rpm)), the rinse hydraulic nozzles 208a and 208b supply a rinse fluid to the core of the front face of a substrate 201, and a tooth back. Since additional energy was needed in order to overcome gravity, it turned out that 400rpm brings about a

rinse with the optimal longitudinal substrate. That is, it is whenever [substrate rotation / of 400 or more rpm], and a rinse fluid is movable to the upper part from the core of a substrate to the rising wood of a substrate. Rinse hydraulic-nozzle 208a after the substrate 201 was fully washed (for example, about 12 seconds), Stop, the heat lamp 115 of an option turns on 208b, and a nitrogen style is introduced into the front face of a substrate 201 through a tube 701. When a motor 207 gathers the rotational speed of a flywheel 205 (up to about 1000 to 2500 rpm) A rinse fluid is removed from a substrate 201 by high rotational speed, and is made to be dried by/or a heat lamp 115, and/or the nitrogen style from a substrate 201.

[0025] A rinse fluid is sprinkled from a substrate 201 to the substrate opposed face of a shielding system between the both sides of a washing step and a desiccation step. Although the main shielding 213 catches most fluids, a fluid adheres also to the part by which the lower part shielding 215, the upper part shielding 217, and the housing lower part are not shielded, or may be condensed on top-face 103c of the SRD housing 103.

[0026] With the suitable operation gestalt, the fluid with which the main shielding 213 collides with the main shielding 213 is partially rebounded at least from there toward the transverse plane of SRD housing, and thereby, the inclination is attached so that a fluid may not form the drop which may fall on the substrate 201 which did not gather on the main shielding 213 but has been arranged downward. Furthermore, since shielding 213, 215, and 217 is hydrophilic properties preferably, the fluid which is not rebounded moves it with breadth along with shielding, without generating the drop which may fall to a substrate 201.

[0027] A fluid flows from the substrate opposed face of the upper part shielding 217 to the top face / non-substrate opposed face of the main shielding 213. A fluid flows to the non-substrate opposed face of the non-substrate opposed face of the main shielding 213 to the lower part shielding 215, and tooth-back 103b of the non-substrate opposed face of the lower part shielding 215 to the SRD housing 103. A rinse fluid flows to 103f of partes basilaris ossis occipitalis of SRD housing along with tooth-back 103b of SRD housing. A fluid is removed from this pars basilaris ossis occipitalis by the pump (not shown).

[0028] Similarly, a fluid flows from the substrate opposed face of the main shielding 213 to the non-substrate opposed face of the lower part shielding 215. The fluid which adheres to either the substrate opposed face of the lower part shielding 215 or a non-substrate opposed face for the suitable acute angle of the lower part shielding 215 flows promptly to tooth-back 103b of SRD housing. The fluid which reaches top-face 103c of SRD housing has the inclination to flow to 2nd side-attachment-wall 103e of housing along with top-face 103c (the inclination of the top face of housing sake). Preferably, top-face 103c of housing is also a hydrophilic property. However, even if the drop of a fluid arises on top-face 103c of SRD housing, those drops fall on the non-substrate opposed face of a shielding system, without contacting a substrate 201, and move along the field.

[0029] If a substrate 201 rotates, a fluid will flow along the front face of a substrate 201, and will carry out the rinse of the residue from there. Some fluids go into the end effector 407 of two or more grippers. however, proximal regions 411a and 411b of the fluid were smooth, and roundish within the end effector 407, -- since it flows along the field of a hydrophilic property preferably, if a flywheel and a substrate 201 rotate, a fluid will move easily from there on turning effort. The fluid which reaches the point which proximal regions 411a and 411b join can also flow from there through a hole 413. Therefore, the

whole front face of a substrate 201 dries (even in case of field in contact with two or more gripper 403 a-c and 405 a-b).
[0030] A plenum 107 is maintained by the pressure (for example, 2 water column inches) lower than the environment (for example, almost atmospheric pressure) which encloses the inside of SRD, and SRD, in order to support desiccation of a substrate 201 further, and in order to promote the flow of the fluid which met the shielding system which goes to tooth-back 103b of the SRD housing 103. Therefore, an air laminar flow is drawn through air-hole 105 a-d, the front-face top of a substrate 201 is flowed, and it goes into a plenum 107 through opening in tooth-back 103b of SRD housing. This airstream has the inclination to assist desiccation of a substrate, and to pour a fluid toward tooth-back 103b of the SRD housing 103 along these front faces since spacing of the length of shielding 213, 215, and 217 is close.
[0031] Since a motor 207 makes rotation of a flywheel 205 late to about 5 rpm after a substrate 201 fully gets dry (for example, after a heat lamp 115 and a nitrogen style are ON for about 5 - 20 seconds), the proximity sensor 209 arranged on tooth-back 103b of SRD housing can detect a flag 211, when a flag 211 is in front of a proximity sensor 209. If a flag 211 is detected by the proximity sensor 209, a proximity sensor 209 will take out and stop a signal on a motor 207. Therefore, when a flywheel 205 and a substrate 201 are in a known location, a flywheel 205 suspends rotation. Especially a substrate is in the location when having been arranged in SRD101. A substrate 201 has the sense decided ideally, before going into SRD101.
[0032] In this known location, the base parts 601a and 601b of the movable grippers 405a and 405b are arranged in front of Pins 603a and 603b, and since an air press actuator (not shown) drives Pins 603a and 603b to the front and contacts the base parts 601a and 601b of the movable grippers 405a and 405b, it opens the movable grippers 405a and 405b. A door 113 slides and opens and a substrate handler (not shown) pulls out a rinse and the dried substrate 201.
[0033] The above-mentioned explanation is indicating only the suitable operation gestalt of this invention, and deformation of the above-mentioned equipment and the approach which are included within the limits of this invention will become clear easily at this contractor. For example, a shielding system is a hydrophilic property and includes shielding of the number of 1 (under existence of an air laminar flow) or arbitration which are designed so that a fluid may be rebounded and an air current may be sent to a substrate, and/or **** by making it approach perpendicularly, and promote the flow of a fluid. A shielding system may incline so that a fluid may be sent to a front face, and it may incline so that a fluid may be sent to the 1st or 2nd side attachment wall of SRD housing. The substrate opposed face and non-substrate opposed face of shielding do not need to be parallel. Furthermore, the shielding system is indicated to have shielding of two or more cone forms which incline from a big diameter to a small diameter. According to this configuration, a desired fluid style is obtained along the top face of a shielding system, and airstream is passed toward the main front face of a substrate, and desiccation on the front face of main is assisted. Perpendicular and/or horizontally alternate configuration with the another upper part of shielding is understood are very good so that a desired fluid style may be obtained. Similarly, when the air current to a substrate is required, this may be attained using other shielding configurations or side-attachment-wall configurations. Profits can be further obtained by preparing a rib (it

extending in the direction of a side attachment wall at a perpendicular) along with the non-substrate opposed face of shielding. Although the shielding system concerning this invention is finally used suitable for single substrate desiccation, the mode of this invention is suitable also like two or more substrate batches. The flag/sensor used for the orientation of a substrate are also changeable. An inert gas dryer style and the device in which carry out induction of the pressure variation and desiccation is promoted are also changeable. The number of grippers and arrangement of a gripper are changeable similarly. Usually, many configurations can attain the principle of this invention of dividing into a closed position the actuator which energizes a movable gripper and is opened from the revolving gripper, and it is still within the limits of this invention. A number of the arbitration of SRD concerning this invention of invention modes are independent, or can actually be combined and used. That is, they are one piece or two or more shielding, an inert gas dryer style, a gripper, an end effector, eccentric positioning, a desirable RPM rinse, substrate cage ENTA, etc. Many of these invention modes can be applied to most substrate spinners, and it does not need to be limited to use by indicated SRD (for example, eccentric positioning, a gripper design, substrate cage ENTA), or can also actually be used within spin RINSA or a spin dryer. Therefore, the spinner contains the equipment (SRD) which does not need to be performed even if it dries by spin RINSA being equipment which performs rotation and a rinse including spin RINSA and SRD so that it may be used on these specifications. naturally the remaining invention other than the fluid style mode (for example, a desirable RPM rinse and a fluid appropriation shielding design) of this invention is applicable to the spinner of the sense (water -- equal) of arbitration, spin RINSA, or SRD Regardless of the sense (for example, level, a perpendicular, etc.) of a substrate, shielding is equally applicable, in order to orient airstream.

[0034] Thus, although this invention has been indicated in connection with a suitable operation gestalt, other operation gestalten being included in the meaning of this invention defined by the claim and within the limits, and getting should be understood.

TECHNICAL FIELD

[Field of the Invention] This invention relates to the approach of washing and drying thin disks, such as a glass substrate, a flat-panel display, a pattern formation settled, or a semi-conductor substrate by which pattern formation is not carried out. Especially this invention relates a semi-conductor substrate to a rinse and the advanced spin-rinse-dryer

to dry.

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PRIOR ART

[Description of the Prior Art] The importance of super-washing processing is increasing as the geometry of a semiconductor device continues reduction. Aquosity washing in a fluid tank (or tub) and the rinse process (for example, what is immersed in a rinse fluid in a substrate and the thing which injects a rinse fluid to a substrate) following it attain a desirable cleanliness level. However, if a dryer is not used after a rinse is completed, a rinse fluid will evaporate from a substrate front face, and a streaking and spotting will arise, and/or tub residue will remain on the front face of a substrate. Such a streaking, spotting, and residue cause a device defect later. Therefore, many cautions have been turned to improving the approach of drying a substrate after the last rinse step.
[0003] In addition to performing desiccation without a streak, such an approach must be able to dry a substrate promptly so that a throughput may be raised, and it must not give a bottleneck to the whole substrate processing system.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] Therefore, a rinse, the approach of drying, and equipment are promptly asked for substrates, such as a semi-conductor substrate, with high dependability.

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MEANS

[Means for Solving the Problem] This invention offers an advanced spin rinse dryer (spin-rinse-drier:SRD). This spin rinse dryer is equipped with the substrate base material made to hold and rotate a longitudinal substrate and the fluid source of the substrate arranged on a substrate base material which can supply a fluid to both sides preferably. Furthermore in the 1st mode, this spin rinse dryer is equipped with 1st at least one shielding designed so that a rinse fluid might be removed from the circumference of a substrate. Especially this shielding is designed so that a rinse fluid may be removed from the field from which a drop can be dropped on the substrate located downward. Therefore, it sets like the 1st voice, and shielding is arranged so that the fluid which moved from this substrate that rotates on a substrate base material may be received, and it rebounds the fluid which received from the substrate. In the 2nd mode, shielding is arranged so that the fluid which moved from the substrate which rotates on a substrate base material may be received, and it contains the substrate opposed face of a hydrophilic property. It is good also considering the whole substrate opposed face of shielding as a hydrophilic property, and shielding of a non-hydrophilic property may be equipped with a hydrophilic wafer opposed face (in for example, field above a substrate). SRD of this invention is equipped with perpendicular and the shielding system which has two or more shielding arranged alternately horizontally in the 3rd mode. These shielding is arranged so that the fluid which moved from the substrate which rotates on a substrate base material may be received, and it can carry and remove a fluid from the field of the substrate upper part. Although used on these specifications, shielding or the shielding system which is arranged alternately perpendicularly or was indicated to have various height and inclinations points out the up field of shielding. The flank and lower field of shielding can have other configurations.
[0006] Other modes of this invention may include/or the still more advantageous description, including various combination of the above-mentioned mode. For example, SRD of this invention may have the pressure gradient impressed in order to carry out induction of the layer air current which crosses a substrate front face and to promote desiccation. You may have narrow spacing perpendicularly so that an air current may promote migration of a fluid in the desirable direction which has arranged two or more shielding so that an air current may be further sent toward a substrate, and met shielding. The lid of SRD of this invention may be a hydrophilic property (in order to promote not

formation of a drop but the intense flow of a fluid), and it may incline in order to draw the flow of a fluid in/or the desirable direction. Furthermore, another mode contains the possible sensor and possible flag of detecting the flywheel of a desired location. The step which supplies a rinse fluid to a substrate, rotating a substrate with the speed of per minute 400 rotation at least is included. The gripper which has the remote pin which can open alternatively the gripper which has the hole or slot which is the gripper which was energized toward closed arrangement, and in which two or more closing motion is free, and has been arranged in the part where a gripper and a substrate contact is included. And/or, it is equipped with the desirable gripper with a radius of circle that it is roundish in two or more directions.

[0007] Other descriptions and advantages of this invention will become clear further enough from detailed explanation of the following suitable operation gestalt, a claim, and an attached drawing.

[0008]

[Embodiment of the Invention] For convenience, it lets the whole drawing pass and the figure on the left of a sign identifies the drawing with which a sign comes out first.

[0009] Drawing 1 and drawing 2 are the front views and tooth-back perspective views showing SRD101 of a rinse and this invention rotated and dried for longitudinal thin disks, such as a semi-conductor substrate, respectively. SRD101 contains housing 103 and front 103a of housing 103 has two or more opening or air hole 105 a-f by which pure air enables it to go into housing 103. The plenum 107 is arranged along with tooth-back 103b of housing 103. A plenum 107 is exhausted through exhaust air Rhine 109, and is connected with the pump (not shown). Since bolting of the top-face 103c of housing 103 is carried out to the side attachment wall of housing 103, when the internal components of SRD101 need after-sale service, it can remove top-face 103c from housing. Since top-face 103c of the SRD housing 103 inclines from the 103d of the 1st side attachment wall to 2nd side-attachment-wall 103e, the fluid which gather on top-face 103c flows to the low top-face 103c side, and flows and falls along with 2nd side-attachment-wall 103e. The heat lamp assembly 111 includes the heat lamp 115 held in the housing 113 attached in front 103a of the SRD housing 103, and housing 113, and the quartz shielding 117. The quartz shielding 117 constitutes a part of front 103a of the SRD housing 103, and it is built with the quartz so that light can be penetrated from a heat lamp 115 to a substrate 201 (see drawing 2). The heat lamp assembly 111 is prolonged covering the die length of the diameter of a substrate 201, and if a substrate 201 rotates, the substrate 201 whole will be heated.

[0010] Top-face 103c of the SRD housing 103 has insertion and the opening 118 of magnitude which can be pulled out for a substrate. In order to open and close opening 111, the door 120 which can be slid is attached on truck 123a of a pair, and 123b so that it may slide forward and backward. 103f of bottom walls of SRD housing inclines toward the lower order point 117. A drain pipe 119 is connected with 103f of bottom walls at the lower order point 117, and removes a rinse fluid from a bottom wall. The feet 121a and 121b of the pair connected with 103f of bottom walls of SRD housing are supporting SRD101. The internal components of SRD101 of this invention are explained with reference to drawing 3 .

[0011] Drawing 3 is the sectional side elevation showing the related part of SRD101 concerning this invention of drawing 1 . The substrate 201 in SRD101 of this invention is

illustrated as supported by the gripper G of the pair prolonged from the pivotable flywheel 205. Another gripper (shown as 403 a-c and 405 a-b) is shown in drawing 5 . A flywheel 205 is connected with a motor 207 through opening of tooth-back 103b of SRD housing. The rinse hydraulic nozzles 208a and 208b of a pair are connected with the source (not shown) of a rinse fluid, and they are arranged so that a rinse fluid may be supplied to the core of the front face of a substrate 201, and a tooth back, respectively. The proximity sensor 209 (for example, capacitive or an inductive proximity sensor) has penetrated the tooth back of SRD housing so that existence of the metal flag 211 attached in the flywheel 205 may be detected. The shielding system including the main shielding 213, the lower part shielding 215, and the upper part shielding 217 encloses the substrate 201. This is separately shown in drawing 4 , and it is explained further, referring to drawing 4 .

[0012] Drawing 4 is the sectional side elevation of the shielding system of SRD concerning this invention of drawing 1 . The desirable main shielding 213 can be explained to be the intercept of the cone which encloses the whole periphery of the substrate 201 arranged on a flywheel 205 (drawing 3). Therefore, the main shielding 213 inclines from a big diameter to the small diameter nearest to a flywheel 205 (drawing 3). The include angle of the substrate opposed face of the main shielding 213 is desirable, and, as for these diameters, it is desirable the range and to be chosen [5-45 degrees (from a normal)] so that it may become 18 degrees most preferably. The substrate opposed face of the main shielding 213 is smooth, and it is desirable that it is a hydrophilic property so that the fluid from the substrate 201 which collides with the substrate opposed face of the main shielding 213 may be rebounded from a substrate opposed face, and/or so that it may prevent flowing along with a substrate opposed face, and a drop's occurring, and falling on a substrate 201. Since the hydrophilic ingredient (for example, quartz) is expensive, it is also possible to use non-hydrophilic-property shielding (for example, plastics shielding), and hydrophilic ingredients, such as a quartz, are attached inside the part of a request of non-hydrophilic-property shielding so that the wafer opposed face or liner of a hydrophilic property may be formed. For example, as shown in drawing 4 , quartz liner 213a may be used for the field (for example, upper half of the main shielding 213) of the substrate upper part. The substrate opposed face and external surface of the main shielding are parallel, and external surface and a substrate opposed face share common inclination between a suitable operation gestalt. It has the upheaval fields 301a and 301b along both edges, a rinse fluid escapes across each edge of the upper external surface of the main shielding 213, and the external surface of the main shielding 213 prevents flowing on the substrate 201 arranged under it.

[0013] Since the main shielding 213 encloses the substrate 201, the main shielding 213 is connected with the 103d (drawing 1) of the 1st side attachment wall of SRD housing, and 2nd side-attachment-wall 103e (drawing 3) by the pneumatic system links 401a and 401b (drawing 5) of a pair. Therefore, the main shielding 213 moves so that insertion of a substrate 201 and a cash drawer may be made, and it separates from Gripper G (drawing 3). The main shielding 213 could move ahead uniformly from Gripper G, or the up field of the main shielding 213 may fully lean ahead so that insertion of a substrate 201 and a cash drawer may become possible.

[0014] Drawing 4 is explained again. The desirable lower part shielding 215 can also be explained to be the intercept of the cone form which encloses the upper half of the

periphery of a substrate 201. The lower part shielding 215 inclines from a big radius to the small radius nearest to a flywheel 205 (drawing 3). the range whose include angle of the substrate opposed face of the lower part shielding 215 of these radii is 5-45 degrees -- since it is chosen so that it may be 36 degrees most preferably, a rinse fluid flows along with a substrate opposed face, and separates from a substrate 201. With a suitable operation gestalt, the substrate opposed face and external surface of the lower part shielding 215 are parallel. The lower part shielding 215 is connected with tooth-back 103b of SRD housing through the bracket 303.

[0015] The upper part shielding 217 can be explained to be a cone intercept, and encloses the upper parts 1/4 of the periphery of a substrate 201. [as well as the main shielding 213 and the lower part shielding 215] The upper part shielding 217 inclines from a big radius to the small radius nearest to a flywheel 205 (drawing 3). the range whose include angle of the substrate opposed face of the upper part shielding 217 of these radii is 5-45 degrees -- since it is chosen so that it may become 10 degrees most preferably, a rinse fluid flows to the direction of the main shielding 213 along with a substrate opposed face (it mentions later further). The upper part shielding 217 is connected with front 103a (drawing 1) of SRD housing through the bracket.

[0016] when a flywheel rotates, the main shielding 213, the lower part shielding 215, and the upper part shielding 217 are perpendicular so that the fluid which moved from the flywheel 205 (drawing 3) may be received -- and it is arranged alternately horizontally and a fluid is moved from the upper field of a substrate 201. With the suitable operation gestalt, the edge with the lower height of the upper part shielding 217 (or edge where a diameter is small) lapped with the edge with the higher height of the main shielding 213 (or edge where a diameter is large), and the edge with the lower height of the main shielding 213 has lapped with the edge with the higher height of the lower part shielding 215 as illustrated. The edge of adjoining shielding is that which is ****(ed) by approaching perpendicularly (for example, 0.3 inches), and in the upper field of a substrate 201, a fluid flows from the substrate opposed face of high shielding of height to the external surface of lower shielding of the height located most in near, stopping a droplet to the minimum. Spacing of the perpendicularly shielding 213, 215, and 217 approached makes easy migration of the fluid which met the shielding system (about the whole actuation of SRD101 of this invention, it mentions later further). Although the desirable upper part and lower part shielding have extended only around the upper part of a substrate, you may extend so that either or both sides may surround the part of the arbitration of a substrate, or the whole periphery. Such extension promotes the flow of the air in the perimeter of the whole periphery of a substrate, and prevents a turbulent flow. Similarly, the main shielding 213 can offer a desirable fluid style and fluid reflection, when having extended only along the upper part of a substrate 201.

[0017] Drawing 5 is the transverse-plane sectional view of SRD concerning this invention of drawing 1 . Three fixed gripper 403 a-c and two movable gripper 405 a-b are contained in two or more grippers ("G" of drawing 3) which support a substrate 201. Fixed gripper 403 a-c and movable gripper 405 a-b are connected with the flywheel 205. Each of each gripper 403 a-c and 405 a-b contains the end effector 407 and the finger part 409. the finger part 409 is indicated by drawing 9 (a) and (b) -- as -- a flywheel 205 -- the fixed coupling -- or it is constituted so that movable connection may be carried out. The end effector 407 of the both sides of fixed gripper 403 a-c and the movable gripper 405 is

constituted so that it may avoid catching a fluid and making it adhere to a substrate 201, while supporting a substrate 201 by the minimum contact. The configuration of an end effector 407 is best understood by drawing 6 and drawing 7 .

[0018] Drawing 6 and drawing 7 are the side elevations and front views of an end effector 407 of SRD101 which are applied to this invention, respectively. Drawing 8 is the perspective view of an end effector 407. An end effector 407 consists of two proximal regions 411a and 411b, it has joined these so that a trough may be made, and it supports a substrate 201 by the minimum contact. A slot or a hole 413 is arranged to the field which proximal regions 411a and 411b join, and a fluid separates from a substrate 201 and may enable it to flow through a hole 413.

[0019] When a substrate is lowered, fixed gripper 403 a-c is ****(ed) along the bottom of a flywheel 205 so that a substrate 201 may be supported in horizontal and the location fixed on vertical both sides. Proximal regions 411a and 411b are roundish to the both sides of a lengthwise direction (between the finger part 409 and substrates 201), and a longitudinal direction (direction which frequents the space of drawing 6), as shown in drawing 6 and drawing 7 , respectively. The front face of proximal regions 411a and 411b is a hydrophilic property smoothly and preferably. Therefore, if the flywheel 205 rotated, a fluid flows along the smooth front face with a radius of circle of proximal regions 411a and 411b, and keep not contacted to a substrate 201. Ideally, two or more gripper 403 a-c and 405 a-b are arranged so that the core of the substrate 201 supported by it may come in the direction of fixed gripper 403 a-c below the core of a flywheel 205 (for example, the core of a flywheel below 0.1-3mm, most preferably under 1mm). By doing in this way, rotation of a substrate 201 pushes a substrate 201 on the direction of fixed gripper 403 a-c. Since fixed gripper 403 a-c does not open, even if a flywheel 205 rotates, it is hard to separate from a substrate 201.

[0020] Drawing 9 (a) and (b) are the side-face perspective views of the movable grippers 405a and 405b in an open position and a closed position, respectively. Each of the movable grippers 405a and 405b contains the base parts 601a and 601b, respectively. In order to open the movable grippers 405a and 405b, since the base parts 601a and 601b of the movable grippers 405a and 405b are contacted, respectively and the base parts 601a and 601b are extruded ahead (going to front wall 103a of SRD housing), the pneumatic system pins 603a and 603b move the finger parts 409a and 409b back, as shown in drawing 9 (a). The air press actuator for pin 603a and 603b (not shown) is held in the plenum 107, and Pins 603a and 603b are slid through opening in tooth-back 103b of SRD housing (not shown), and contact the base parts 601a and 601b of the movable grippers 405a and 405b. The springs 605a and 605b of a pair energize the movable grippers 405a and 405b to a closed position (drawing 9 (b)). In this closed position, the pins 603a and 603b which contact the base parts 601a and 601b of the movable grippers 405a and 405b, respectively do not exist.

[0021] Drawing 10 (a) and (b) are the sectional side elevations and transverse-plane sectional views showing the dryer style of the option used into SRD which starts this invention of drawing 1 , respectively. As shown in drawing 10 (a) and (b), the dryer style of an option contains the Teflon (trademark) tubing 701 preferably prolonged along with the diameter of the perpendicular direction of a substrate 201. The gas stream which the 1st edge of the Teflon tubing 701 is connected with the source 702 of semi-conductor grade clean dry inert gas (for example, nitrogen, CO2, AR, HE, etc.), and the 2nd edge of

the Teflon tubing 701 has cap 703, or a seal is carried out by the option, and passes along tubing is prevented. The Teflon tubing 701 is made to approach the front face of a substrate 201, and is attached. Two or more holes 705 exist in the field of the Teflon tubing 701 which counters a substrate 201. Constituting without making magnitude project is desirable so that it may not prevent that most front faces of a substrate 201 contact the airstream which the Teflon tubing 701 or the same dryer style is drawn [airstream] through air hole 105 a-f, and has the front-face top of a substrate 201 passed through a plenum 107, and so that migration of the main shielding 213 may not be blocked (for example, the Teflon tubing 701 is attached in a front wall). As for the number between two or more holes 705, spacing and the flow rate of inert gas, and spacing of the Teflon tubing 701 and a substrate 201, a low fluidity laminar flow with smooth inert gas is chosen so that it may assist a sink and/or making it evaporate for the front face of a substrate 201 to a fluid. Since removing a fluid from the edge of a substrate 210 has more difficult possibility, spacing between holes 705 decreases in the field of the Teflon tubing 701 corresponding to the edge of a substrate 201. Other forms can be used although the dryer style of the shape of thin tubing is desirable (the shower head, a square, rectangle, etc.). Similarly, a dryer style can be made into the magnitude of arbitration (for example, area is equal to the substrate which should be dried).

[0022] It slides along Trucks 123a and 123b during actuation to the open position where opening 118 exposes a substrate 201 as a slide door 120 is shown in drawing 1 and drawing 2 , a rinse and in order to dry. A flywheel 205 has a proximity sensor 209 in the position which detects the metal flag 211 so that alignment of the base parts 601a and 601b of the movable grippers 405a and 405b may be carried out ahead [of Pins 603a and 603b]. Pins 603a and 603b are sent ahead, the base parts 601a and 601b of the movable grippers 405a and 405b are contacted, and the movable grippers 405a and 405b are opened, and it moves ahead in Links 401a and 401b, and is made for delivery and the main shielding not to surround gripper 403 a-c and 405 a-b for the main shielding 213 any longer ahead, as shown in drawing 9 (a). A substrate handler (not shown) drops a substrate 201 through opening 111, and lays a substrate 201 on fixed gripper 403 a-c. Fixed gripper 403 a-c supports a substrate 201 to the fixed position where the core of a substrate 201 is located under the core of a flywheel 205. If an air press actuator (not shown) retreats Pins 603a and 603b gradually so that the movable grippers 405a and 405b may close gradually, and a door 121 slides to a closed position, it will be set in the condition of having contacted proximal regions 411a and 411b (drawing 5 and drawing 6) to the substrate 201.

[0023] Then, a flywheel 205 begins to rotate. Since the core of a substrate 201 has shifted in the direction of fixed gripper 403 a-c from the core of a flywheel 205, rotation pushes in a substrate 201 in the direction of fixed gripper 403 a-c firmly. Therefore, the movable grippers 405a and 405b receive the minimum force, and a substrate 201 cannot separate from them easily from gripper 403 a-c and 405 a-b.

[0024] Rotating a flywheel 205 in the beginning at a low speed (for example, 100 - 500 revolution per minute (rpm)), the rinse hydraulic nozzles 208a and 208b supply a rinse fluid to the core of the front face of a substrate 201, and a tooth back. Since additional energy was needed in order to overcome gravity, it turned out that 400rpm brings about a rinse with the optimal longitudinal substrate. That is, it is whenever [substrate rotation / of 400 or more rpm], and a rinse fluid is movable to the upper part from the core of a

substrate to the rising wood of a substrate. Rinse hydraulic-nozzle 208a after the substrate 201 was fully washed (for example, about 12 seconds), Stop, the heat lamp 115 of an option turns on 208b, and a nitrogen style is introduced into the front face of a substrate 201 through a tube 701. When a motor 207 gathers the rotational speed of a flywheel 205 (up to about 1000 to 2500 rpm) A rinse fluid is removed from a substrate 201 by high rotational speed, and is made to be dried by/or a heat lamp 115, and/or the nitrogen style from a substrate 201.

[0025] A rinse fluid is sprinkled from a substrate 201 to the substrate opposed face of a shielding system between the both sides of a washing step and a desiccation step. Although the main shielding 213 catches most fluids, a fluid adheres also to the part by which the lower part shielding 215, the upper part shielding 217, and the housing lower part are not shielded, or may be condensed on top-face 103c of the SRD housing 103.

[0026] With the suitable operation gestalt, the fluid with which the main shielding 213 collides with the main shielding 213 is partially rebounded at least from there toward the transverse plane of SRD housing, and thereby, the inclination is attached so that a fluid may not form the drop which may fall on the substrate 201 which did not gather on the main shielding 213 but has been arranged downward. Furthermore, since shielding 213, 215, and 217 is hydrophilic properties preferably, the fluid which is not rebounded moves it with breadth along with shielding, without generating the drop which may fall to a substrate 201.

[0027] A fluid flows from the substrate opposed face of the upper part shielding 217 to the top face / non-substrate opposed face of the main shielding 213. A fluid flows to the non-substrate opposed face of the non-substrate opposed face of the main shielding 213 to the lower part shielding 215, and tooth-back 103b of the non-substrate opposed face of the lower part shielding 215 to the SRD housing 103. A rinse fluid flows to 103f of partes basilaris ossis occipitalis of SRD housing along with tooth-back 103b of SRD housing. A fluid is removed from this pars basilaris ossis occipitalis by the pump (not shown).

[0028] Similarly, a fluid flows from the substrate opposed face of the main shielding 213 to the non-substrate opposed face of the lower part shielding 215. The fluid which adheres to either the substrate opposed face of the lower part shielding 215 or a non-substrate opposed face for the suitable acute angle of the lower part shielding 215 flows promptly to tooth-back 103b of SRD housing. The fluid which reaches top-face 103c of SRD housing has the inclination to flow to 2nd side-attachment-wall 103e of housing along with top-face 103c (the inclination of the top face of housing sake). Preferably, top-face 103c of housing is also a hydrophilic property. However, even if the drop of a fluid arises on top-face 103c of SRD housing, those drops fall on the non-substrate opposed face of a shielding system, without contacting a substrate 201, and move along the field.

[0029] If a substrate 201 rotates, a fluid will flow along the front face of a substrate 201, and will carry out the rinse of the residue from there. Some fluids go into the end effector 407 of two or more grippers. however, proximal regions 411a and 411b of the fluid were smooth, and roundish within the end effector 407, -- since it flows along the field of a hydrophilic property preferably, if a flywheel and a substrate 201 rotate, a fluid will move easily from there on turning effort. The fluid which reaches the point which proximal regions 411a and 411b join can also flow from there through a hole 413. Therefore, the whole front face of a substrate 201 dries (even in case of field in contact with two or more gripper 403 a-c and 405 a-b).

[0030] A plenum 107 is maintained by the pressure (for example, 2 water column inches) lower than the environment (for example, almost atmospheric pressure) which encloses the inside of SRD, and SRD, in order to support desiccation of a substrate 201 further, and in order to promote the flow of the fluid which met the shielding system which goes to tooth-back 103b of the SRD housing 103. Therefore, an air laminar flow is drawn through air-hole 105 a-d, the front-face top of a substrate 201 is flowed, and it goes into a plenum 107 through opening in tooth-back 103b of SRD housing. This airstream has the inclination to assist desiccation of a substrate, and to pour a fluid toward tooth-back 103b of the SRD housing 103 along these front faces since spacing of the length of shielding 213, 215, and 217 is close.

[0031] Since a motor 207 makes rotation of a flywheel 205 late to about 5 rpm after a substrate 201 fully gets dry (for example, after a heat lamp 115 and a nitrogen style are ON for about 5 - 20 seconds), the proximity sensor 209 arranged on tooth-back 103b of SRD housing can detect a flag 211, when a flag 211 is in front of a proximity sensor 209. If a flag 211 is detected by the proximity sensor 209, a proximity sensor 209 will take out and stop a signal on a motor 207. Therefore, when a flywheel 205 and a substrate 201 are in a known location, a flywheel 205 suspends rotation. Especially a substrate is in the location when having been arranged in SRD101. A substrate 201 has the sense decided ideally, before going into SRD101.

[0032] In this known location, the base parts 601a and 601b of the movable grippers 405a and 405b are arranged in front of Pins 603a and 603b, and since an air press actuator (not shown) drives Pins 603a and 603b to the front and contacts the base parts 601a and 601b of the movable grippers 405a and 405b, it opens the movable grippers 405a and 405b. A door 113 slides and opens and a substrate handler (not shown) pulls out a rinse and the dried substrate 201.

[0033] The above-mentioned explanation is indicating only the suitable operation gestalt of this invention, and deformation of the above-mentioned equipment and the approach which are included within the limits of this invention will become clear easily at this contractor. For example, a shielding system is a hydrophilic property and includes shielding of the number of 1 (under existence of an air laminar flow) or arbitration which are designed so that a fluid may be rebounded and an air current may be sent to a substrate, and/or **** by making it approach perpendicularly, and promote the flow of a fluid. A shielding system may incline so that a fluid may be sent to a front face, and it may incline so that a fluid may be sent to the 1st or 2nd side attachment wall of SRD housing. The substrate opposed face and non-substrate opposed face of shielding do not need to be parallel. Furthermore, the shielding system is indicated to have shielding of two or more cone forms which incline from a big diameter to a small diameter. According to this configuration, a desired fluid style is obtained along the top face of a shielding system, and airstream is passed toward the main front face of a substrate, and desiccation on the front face of main is assisted. Perpendicular and/or horizontally alternate configuration with the another upper part of shielding is understood are very good so that a desired fluid style may be obtained. Similarly, when the air current to a substrate is required, this may be attained using other shielding configurations or side-attachment-wall configurations. Profits can be further obtained by preparing a rib (it extending in the direction of a side attachment wall at a perpendicular) along with the non-substrate opposed face of shielding. Although the shielding system concerning this

invention is finally used suitable for single substrate desiccation, the mode of this invention is suitable also like two or more substrate batches. The flag/sensor used for the orientation of a substrate are also changeable. An inert gas dryer style and the device in which carry out induction of the pressure variation and desiccation is promoted are also changeable. The number of grippers and arrangement of a gripper are changeable similarly. Usually, many configurations can attain the principle of this invention of dividing into a closed position the actuator which energizes a movable gripper and is opened from the revolving gripper, and it is still within the limits of this invention. A number of the arbitration of SRD concerning this invention of invention modes are independent, or can actually be combined and used. That is, they are one piece or two or more shielding, an inert gas dryer style, a gripper, an end effector, eccentric positioning, a desirable RPM rinse, substrate cage ENTA, etc. Many of these invention modes can be applied to most substrate spinners, and it does not need to be limited to use by indicated SRD (for example, eccentric positioning, a gripper design, substrate cage ENTA), or can also actually be used within spin RINSA or a spin dryer. Therefore, the spinner contains the equipment (SRD) which does not need to be performed even if it dries by spin RINSA being equipment which performs rotation and a rinse including spin RINSA and SRD so that it may be used on these specifications. naturally the remaining invention other than the fluid style mode (for example, a desirable RPM rinse and a fluid appropriation shielding design) of this invention is applicable to the spinner of the sense (water -- equal) of arbitration, spin RINSA, or SRD Regardless of the sense (for example, level, a perpendicular, etc.) of a substrate, shielding is equally applicable, in order to orient airstream.

[0034] Thus, although this invention has been indicated in connection with a suitable operation gestalt, other operation gestalten being included in the meaning of this invention defined by the claim and within the limits, and getting should be understood.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the transverse-plane perspective view of SRD of this invention.

[Drawing 2] It is the tooth-back perspective view of SRD of this invention.

[Drawing 3] It is the sectional side elevation of SRD concerning this invention of drawing 1 .

[Drawing 4] It is the sectional side elevation of the shielding system of SRD concerning

this invention of drawing 1 .
[Drawing 5] It is the transverse-plane sectional view of SRD concerning this invention of drawing 1 .
[Drawing 6] It is the side elevation of the gripper end effector of SRD concerning this invention of drawing 1 .
[Drawing 7] It is the front view of the gripper end effector of SRD concerning this invention of drawing 1 .
[Drawing 8] It is the perspective view of an end effector 407.
[Drawing 9] It is the side elevation of the gripper of drawing 6 -8, and (a) shows the gripper in an open position and (b) shows the gripper in a closed position.
[Drawing 10] (a) is the sectional side elevation showing the dryer style of the option used within SRD concerning this invention of drawing 1 , and (b) is the transverse-plane sectional view showing this dryer style.
[Description of Notations]
101 [-- Plenum,] -- SRD, 103 -- Housing, 105 a-f -- An air hole, 107 109 -- Exhaust air Rhine, 111 -- A heat lamp assembly, 118 -- Opening, 201 -- A substrate, 205 -- A flywheel, 207 -- A motor, 208a, 208b -- A rinse hydraulic nozzle, 209 -- A proximity sensor, 211 -- Metal flag, 213 -- Main shielding, 213a -- A quartz liner, 215 -- Lower part shielding, 217 -- Upper part shielding, 301a, 301b -- An upheaval field, 403 a-c, 405 a-b [-- Proximal region 413 / -- A slot, 601a, 601b / -- A base part, 603a, 603b / -- An air operated pin, 605a, 605b / -- Spring.] -- A gripper, 407 -- An end effector, 409 -- A finger part, 411a, 411b

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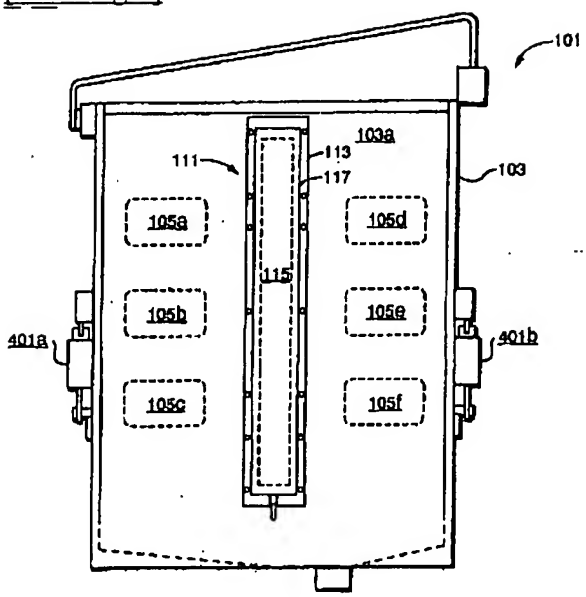
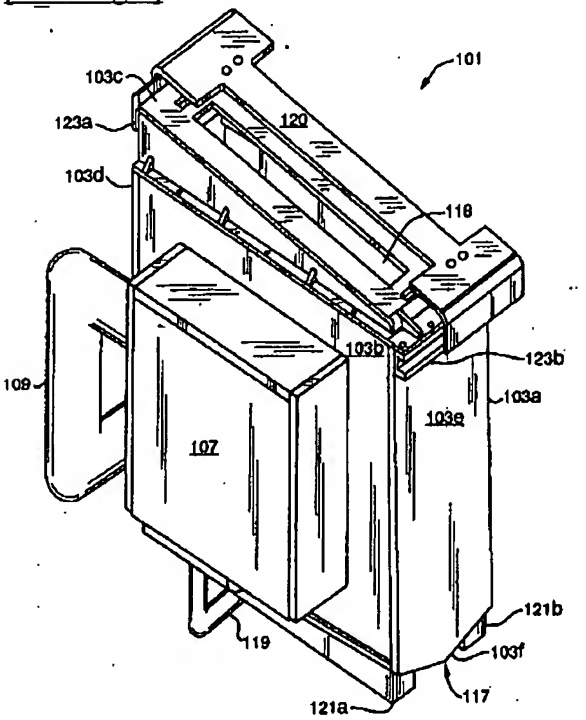
DRAWINGS

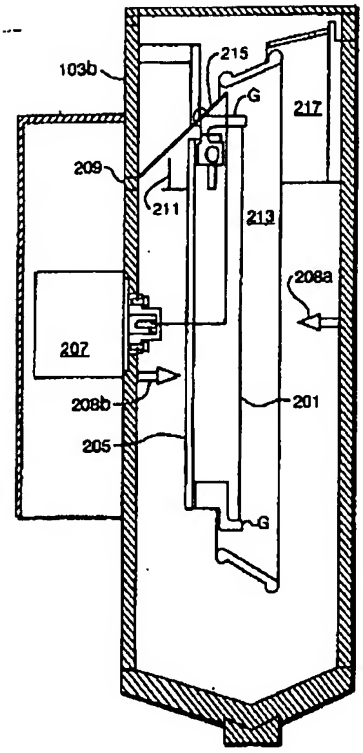
[Drawing 1]



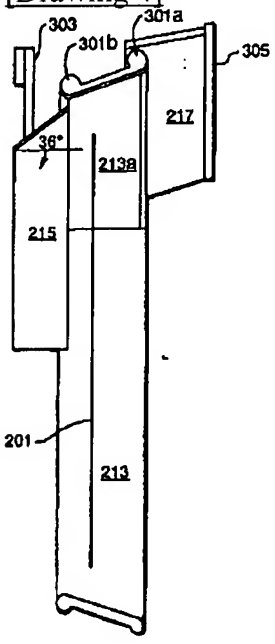
[Drawing 2]



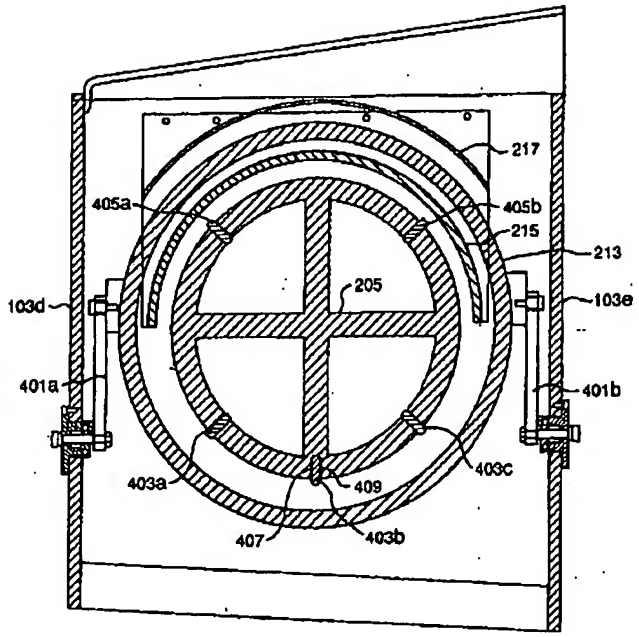
[Drawing 3]



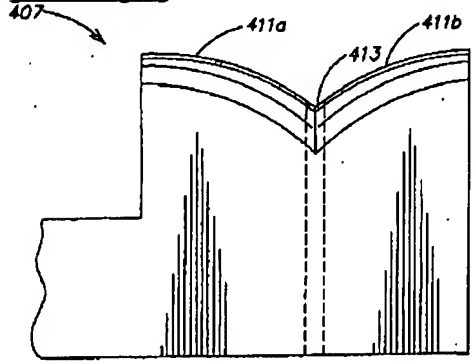
[Drawing 4]



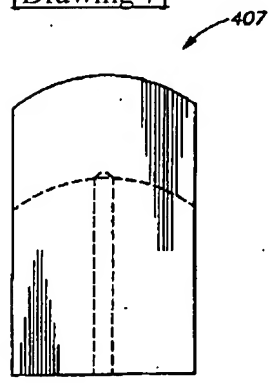
[Drawing 5]



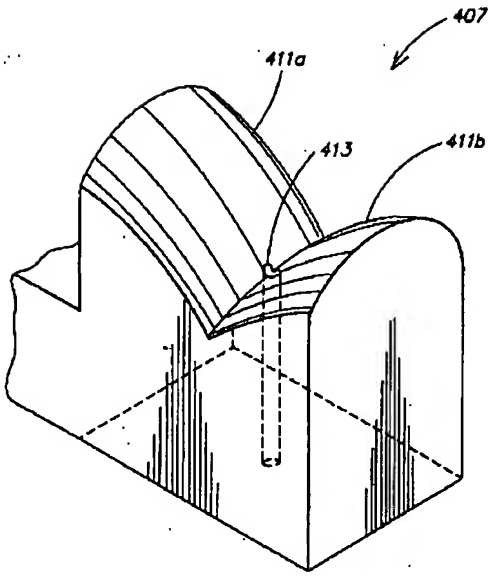
[Drawing 6]



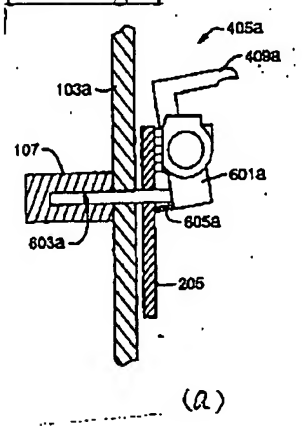
[Drawing 7]



[Drawing 8]



[Drawing 9]



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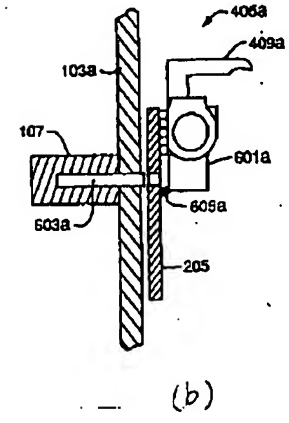
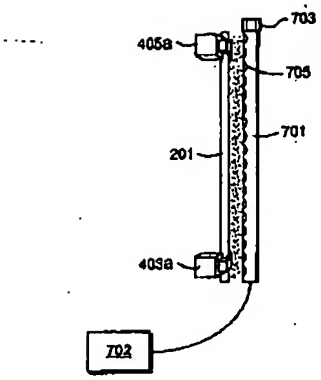
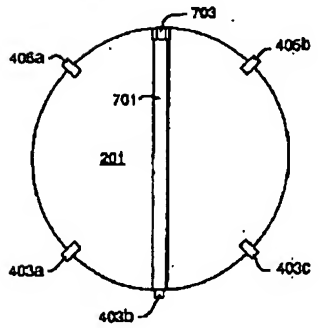


(b)

[Drawing 10]



(a)



(b)

[Translation done.]